

Copley Station/Boston Public Library Test Pitting and Granite Bench Protocol

The MBTA proposes to perform a series of test pits in the area of the proposed Copley Station elevator, which is located in front of the McKim Building of the Boston Public Library (BPL). One of the purposes of the test pits is to determine the exact location of a 30" sewer line which wraps around the headhouse. The 30" sewer line runs parallel to the building and in some places, practically beneath the bench structures. Additionally, the test pits will allow the contractor to identify the exact location of and the condition of the foundation structures of the McKim Building. The test pits will assist in providing information on a series of unknown subsurface issues in and around the location of the proposed elevator.

It is necessary, prior to the sewer relocation, to excavate around the area to see what obstructions may be in place as well as to confirm as-built information of underground structures with certainty. The test pits are designed to provide detailed information on current subsurface conditions.

A. Test Pitting and Reconnaissance

The plan view attached to this narrative depicts the locations of the pits described below (see Tab A).

The purpose of **TP-1** is to confirm the foundation for the monument. The MBTA and its contractor anticipate that the monument is resting on the roof of the tunnel structure within 4 feet of the surface and may be cantilevering slightly off the edge of the tunnel roof. A good understanding of how the monument is supported is a necessity for writing procedures for protecting and planning for procedures dealing with the monument. This pit will be dug by hand. Prior to digging, the monument will be protected with an enclosure to prevent the monument from being damaged during excavation. See the sketch attached to this narrative (Tab B). It is necessary that the test pit be of a sufficient area to expose and identify the subsurface conditions. The area will be limited to the minimum area and depth needed to sufficiently expose subsurface structures. This may require excavating around the perimeter of the monument where the granite pavers have been removed. This pit needs to be dug and the monument support identified prior to moving on to the other two test pits.

The purpose of **TP-1A** is to confirm the foundation of the remaining granite bench and step stone at the Library wall as well as to ascertain its physical connection to the Library and the Copley Station headhouse walls and foundation. The overlay of the last remaining L-shaped granite bench over the existing Copley in-bound headhouse indicates that about 80% of the bench is located directly over the concrete roof of the headhouse. The location of the granite bench, step stone, and plinth are determined by the field survey and the dimensions of the headhouse below are based on the current and existing design documents. The bottom of bench is approximately two feet above the top of subway station lobby.

This information indicates that the granite benches over and near the top of subway roof were most likely removed during construction of the in-bound entrance. They were then reinstalled, most likely with direct support from the roof and much stronger cementitious mortar to the granite stone behind. It is also noted that preconstruction field survey and observation show no differential settlements among bench stones along the building. This further indicates that the bench stone is likely on firm support from underneath.

The last bench stone is approximately 5 feet long and 2.5 feet wide along the face of McKim Building. Its back side is mortared to the foundation stone of the building behind. The bottom front (northern) edge of the bench directly sits on the step stone below and overlaps for approximately 2 inches. The adjacent bench stone to the west has already been removed. The west face of the stone is exposed to air and accessible to explore and examine its support underneath. The plinth granite slabs in front

of the bench are located directly over the manhole and 30-inch sewer line and extend further to the west for 5 to 7 feet beyond the west wall of underground headhouse structure and into the future construction area. These step stones and plinth pavers must be removed for future excavation and construction work. However it may be possible to not remove the bench stone depending on the condition of support from underneath. To make the determination, the exact location of the existing subway roof underneath the bench and condition of its support must be determined through a test pit. The results of the test pit may also provide the possibility of underpinning the bench directly from the existing tunnel structure below.

The test pit for the bench can be hand dug from the exposed western side of the stone underneath towards the existing subway roof. The width of the test pit will be limited to the width of bench stone. The purpose of the test pit is to expose and examine the support of the bench. The observation of the support condition of the benches that have already been removed reveals that they are supported on short brick walls perpendicular to the building at a few feet intervals. Therefore, the hand excavation of the test pit should avoid damage and/or removal of similar brick mortared supporting walls or any other solid material such as concrete under the bench granite. Only soft material such as soil and loose debris will be removed to expose the support and/or the existing headhouse roof. Hand excavation will not extend more than one third length of the bench (20 inches) from the west face underneath.

The MBTA will ensure that the contractor will take all necessary steps to avoid, to the greatest degree possible, the need to remove the bench from the wall of the McKim Building. Throughout the test pitting procedure, the contractor's goal should be to leave the remaining bench in place, if the bench can be adequately and properly protected from damage. During the course of the test pit operations, the determination as to whether or not the bench must be removed will be made in accordance with the following potential courses of action, listed in order from least to most invasive.

1. If **TP-1A** reveals adequate support of bench exists, and the bench can be adequately protected during construction, no action required except protection of the bench during construction.
2. If **TP-1A** reveals that existing support is not adequate, and/or the bench cannot be adequately protected during construction, the MBTA will ensure that the contractor will install temporary shoring for test pitting operation and explore what, if any long-term solution for construction may be needed.
3. If **TP-1A** reveals support is not adequate for either a temporary and/or the bench cannot be adequately protected during construction, or an extended period of time during the construction period, the MBTA will ensure that the contractor will install an underpinning system to protect the bench through the entire construction period.
4. If **TP-1A** reveals that the existing support is not adequate, the MBTA will ensure that the contractor will remove the bench in accordance with section C (2) of this protocol.

The MBTA will determine the adequacy of the existing support and the constructability of supplemental support (if it is necessary). The MBTA will direct the contractor to provide a proposal recommending the most feasible and least invasive course of action given the findings. The proposal, along with the MBTA's recommended action plan, will be submitted to the Federal Transit Administration (FTA), the Massachusetts Historical Commission (MHC), and the Project Conservator (PC) for review and consultation. Any supplemental support or removal of the bench will not be attempted without the explicit consent and acknowledgement of the City and Library representatives.

All necessary protection measures must be taken to ensure the safety of workers and avoid damage to the stone. The general contractor's superintendent must be present on site to supervise the work. The test pit work must be stopped whenever there is any sign of safety risk or bench movement. The PC and engineer will also be present during the test pit excavation to assess the adequacy of safety condition and protection of the bench.

After the support for the bench granite and/or roof of the existing subway are exposed, the PC, BPL stone expert, and engineer will examine and evaluate the actual field condition and determine if the bench can be reliably supported in place during future work either by the existing condition or additional underpinning measures.

The purpose of **TP-2** is to confirm the configuration of the existing tunnel structure, the earth support left in place after the subway tunnel construction, the 30" sewer line, and the manhole that are adjacent to the library in the area of the proposed elevator structure. If the contractor's current assumption on the subsurface condition of the monument is confirmed during the TP-1 excavation, there will be no risk of undermining the monument because it is being supported by the tunnel structure. If TP-1 reveals something different than what is expected, this plan may need to be adjusted to meet field conditions. The area to be excavated will be dug with a hydraulic excavator as an open cut to 4 feet of depth and then the trench box will be placed into the excavation. Once the trench box is in place, further excavation will be done inside the trench box and the sides of the box will be carefully pushed down as soil is removed. Protection of the monument will be achieved by careful work and proper supervision while this work is being done. Adjacent stone to remain in place will be protected by framing lumber and plywood to prevent exposed edges from damage by construction equipment and activities. The exterior Library wall within the test pit area will be protected with tarps to a height of 8 feet above the current plaza elevation. A graphic showing the plans to protect the monument is attached at Tab B.

The purpose of **TP-3** is to confirm the configuration of the Library wall foundation. The excavator will be positioned between the test pit and Boylston Street. The area to be excavated will be dug with a hydraulic excavator as an open cut to 4 feet of depth and then the trench box will be placed into the excavation. Once the trench box is in place, further excavation is done inside the trench box and the sides of the box are carefully pushed down as soil is removed. Protection of the McKim Building will be achieved by careful work and proper supervision while this work is being done. Adjacent stone to remain in place will be protected by framing lumber and plywood to prevent exposed edges from damage by construction equipment and activities. The exterior Library wall within the test pit area will be protected with tarps to a height of 8 feet above the current plaza elevation. A graphic showing the plans to protect the McKim Building is attached at Tab C.

Throughout all of the test pit work, the MBTA will ensure that the contractor will take adequate steps to protect the wrought iron Copley Station Inbound Headhouse. A series of two or three jersey barriers will be placed between the western edge of the headhouse and the work area will be put in place prior performing the test pit work. The jersey barriers will prevent any accidental impact between equipment and the headhouse. A graphic showing the plans to protect the wrought iron headhouse is attached at Tab D..

B. Granite Paver and Bench Removal

In order to perform any test pitting, one historic granite paver must be removed. Additionally, it may become necessary to remove the corner bench located in the area of TP-1A, if, during field investigations, it becomes clear that the bench has insufficient support. Historic granite pavers and benches at the proposed Copley in-bound elevator shaft will be removed and stored in a careful and workmanlike manner as follows:

1. **Documentation and Preparation:** A visual survey with archival, detailed photographs will be performed of the area prior to commencing any removal work. Any pre-existing damage will be noted and photographically documented. Temporary identification labels corresponding to the number to be hand painted on the back of each stone will appear for each stone in the photographs.

All masons to be assigned to the removal work should have demonstrated prior experience removing and handling similar granite stonework on historic structures.

Remaining bench stones to be removed will first be cleaned with a solution of dishwashing liquid soap and water applied with a nylon scrub brush and rinsed with clear water. Once the stone is cleaned, it will be inspected for incipient cracks.

2. **Stone Removal:** The vertical joint between the bench stones and the facade of the Library will be completely freed prior to attempting to move the stone in any direction. Joint material will be removed by hand tools or by circular saw with a masonry blade where necessary. If the depth of the joint is deeper than the saw blade, the joint will be drilled out with custom $\frac{1}{4}$ " x 24" long masonry drill bits to assist in releasing the bond between the stone and the mortar. This joint drilling will be done in a pattern of vertical drill holes 1 inch on center, then diagonal drill holes in both directions 1 inch on center as necessary. Horizontal joint drilling will be done where space allows.

Removal of the mortar for the full depth of the stone will be verified by passing a slim jim along the joint to confirm that the mortar has been removed over the entire vertical contact area of the stone. In the event that the saw and drill method is unable to completely remove the joint material (*i.e.*, tight corners or difficult material), high pressure water jet cutting equipment will be utilized to remove the remaining material. (See attached catalog cuts at Tab F.) During this operation, the adjacent horizontal stone surface will be protected by a 6"-wide steel plate for the length of the joint. Once the contractor's stone mason confirms that the joint is verified clear, wooded wedges will be employed around the entire perimeter of the vertical joint in the direction of travel to move the stone horizontally toward the street. Thin metal plates will be placed on the plinth stone in front of the seat stone to facilitate movement. Pneumatic tools will be used as necessary to break up the underlayment mortar from beneath the stones. This will be done in an undermining operation that will remove material from under the stones if necessary.

Once the stone is proven free of the surrounding structure, the stone will then be carefully lifted with wooden wedges and pinch bars to provide space for dunnage to be placed under the stone to provide a space for nylon lifting slings to be placed under the stone. Ferrous dowels if encountered will be cut with a reciprocating saw or an electric grinder. All contact between the prying bars and the stone will be cushioned with rubber or wooden padding. Once the granite/mortar bond is released, the piece will be lifted with a nylon sling and placed on wooden resting blocks. Specific care will be taken to prevent damage to the arris edges of the stones. Pry bars will not be used on the exposed finished edges of stone without adequate protection. Once stones are free from their dowels, the dowels will be removed so no metal material will be left in the stones. This will be done by core drilling around the dowel or anchor. The cored holes will be used for new stainless steel dowels during re-installation. Pieces will be mapped and as each is removed numbered with hand paint on the easterly unexposed face. Painted numbers will then be ground into the unexposed face as a back up to the paint markings.

The MBTA will ensure that the contractor will employ a stone mason who will have demonstrated prior experience removing and handling similar granite stone work on

historic structures. The contractor's stone mason expert will be experienced in the *Secretary of the Interior's Standards for Rehabilitation and Illustrated Guidelines for Rehabilitating Historic Buildings* (U.S. Department of the Interior, National Park Service, 1992).

No stone will be attempted to be removed without the explicit consent and acknowledgement of the City and Library representatives, as well as after consultation with FTA and MHC.

3. **Protection of Adjacent Area to Remain:** Adjacent stone to remain in place will be protected by framing lumber and plywood to prevent exposed edges from damage by construction equipment and activities. The exterior Library wall within the excavation and staging area will be protected with tarps to a height of 8 feet above the current plaza elevation. Any existing exhaust air vents to be exposed will be temporarily ducted away from the construction area to prevent dust, noise, and rain from entering the duct. The space between the ducts and the remaining granite will be filled in with lumber and caulked to prevent water infiltration. Fortunately, these ducts handle exhaust air and are less of an exposure problem than intake air ducts would pose. The area immediately surrounding the openings will be graded in such a way that any water accumulation will run away from the openings. Any waterproofing damaged by the removal and construction process will be repaired to the satisfaction of the BPL and the City of Boston agencies.
4. **Repair:** Every effort will be made to remove these pavers, benches without damaging them; however it can not be guaranteed that all pieces can be removed without some damage. In the case of any pieces broken during this process, they will be repaired in accordance with recommendations from Mr. Ivan Myjer who is the library's expert stonework consultant. This work will be performed by qualified specialists at a granite cutting shop off site.
5. **Transportation and Storage:** The material will be hoisted with the nylon slings onto a flatbed truck for transportation to J.F. White's equipment yard at 76 Old Page Street in Stoughton. Once the material arrives in the yard, it will be unloaded at a jersey barrier-protected area where the stone will be placed on dunnage and stored in accordance with the requirements of Specification Section 04450. Material will be laid out in storage with no stacking of stones.

Once the granite work has been completed, a test pitting operation will be conducted to determine the location and nature of the subsurface features in the area of the proposed elevator shaft. At the completion of the test pitting operation, the area will be temporarily backfilled leaving the surface at a lower elevation than the existing granite plaza in the area of the granite removal.

C. Oversight

Oversight will be performed by the contractor who shall employ a supervisor with demonstrated prior experience with historic masonry removal consistent with the *Secretary of the Interior's Standards for Rehabilitation and Illustrated Guidelines for Rehabilitating Historic Buildings* (U.S. Department of the Interior, National Park Service, 1992).

The supervisor will be present during all work described in this document, and will be responsible for preserving the integrity of all existing historic building elements in the vicinity of this work. In the event that the supervisor determines that any of the work in the test pitting or bench removal process is being performed in a manner that is inconsistent with this protocol, or if any damage or previously

unanticipated conditions occur, the supervisor will immediately cease work and inform the MBTA Project Manager and/or Resident Engineer, who will inform the Project Conservator.

The Project Conservator, serving in an advisory role to the MBTA, will be given adequate notice and will be present for critical portions of the work described in this document and be kept abreast of progress directly by the contractor. As an agent for the MBTA, should the PC become concerned for the integrity of the historic elements, they will recommend the supervisor to stop work and solicit further direction from the MBTA Project Manager and/or Resident Engineer.

The MBTA will also provide the FTA, MHC, and BPL, as well as the Boston Landmarks Commission with the opportunity to observe the test pitting and any required bench support or bench removal activities. Each of the parties will receive adequate notification of the work.

Attachments:

- Tab A -- Plan view depicting the locations of the pits
- Tab B -- A graphic showing the plans to protect the monument
- Tab C -- A graphic showing the plans to protect the McKim Building
- Tab D -- A graphic showing the plans to protect wrought iron headhouse
- Tab E -- Catalogue Cut for High Pressure Water Cutting Equipment